



## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

Figure 1 is an exploded isometric view of a semi-tubular limiter showing also the attached container 60, lid 63 and annular elements 65s. Container 60 and lid 63 are adapted to define a storage space for a small piece of paper. Thus lid 63 closes the storage space at its end proximate the elements 65, preventing the paper from being extracted until elements 65s are demounted from the limiter.

Figure 2 is a cross-section through container 60 in a plane perpendicular to the axis of rotation showing a boss 66 which fixes the container on the limiter.

Figures 3 and 4 are cross-sectional views showing a catch part 137 at one end of the core of said first apparatus. Figure 3 shows the catch part just prior to its engagement during the process of assembling the core. Figure 4 shows the catch part afterward as it secures the core by trapping a bent portion 114 of the molded plastic spindle 112. Figures 3 and 4 show one end only of the core using the same plane of cross-section.

Figure 5 is a plan view of a core in accordance with the invention including a detachable handle 99.

Figure 6 is a cross-sectional view of the handle 99 showing protuberance 89 which is adapted to engage bent spindle portion 114 when the handle is deployed to release the fastening device. In figure 6, handle 99 is shown detached from the core.

Figure 7 is a cross-sectional view of the semi-tubular limiter of figure 1. Shown secured on the limiter are the container 60 and the lid 63. Lid 63 has been fully connected to container 60 in this drawing so that just sufficient space remains on

the limiter for a whole number of elements 65s to be rotatably confined at the external end of lid 63.

Figure 8 is a cross-sectional view of the apparatus of figure 9, showing a lid 207 which differs in its construction from the lid of said first apparatus. The plane of the cross-section separates lid 207 from the adjacent annular element 201. Thus it may be seen that lid 207 does not itself close the storage space for object 218 which is held therein. Rather effective closure of the storage space in this apparatus is achieved through the annular elements 201s, said object 218 comprising a rigid mass such as a coin rather than a thin flexible object such as a piece of paper.

Figure 9 is a pictorial view of a complete apparatus in accordance with the invention. The apparatus is shown here in its solution state wherein the core may be directly slid out of the limiter without further rotation of annular elements on the limiter.

Figure 10 is a view of the prior art apparatus. The core in this apparatus readily falls apart when it is withdrawn.

## DETAILED DESCRIPTION OF THE INVENTION

With reference to figure 1, congruent annular elements 65s are employed in said first apparatus, each with six equally spaced interior keyways including one keyway larger than the rest. A semi-tubular limiter 61 is bifurcated at one end whereby the lips 69, 70 at that end may be pressed together to facilitate the mounting of said annular elements on 61. At the other end of 61, container 60 is secured.

Container 60 includes a curved interior wall 72, a curved exterior wall 71 and flat side walls 73, 74 whereby it defines a cavity 67 sealed at one end. Interior wall 72 subtends 270 degrees only in a plane orthogonal to the axis of rotation. Elements 65s may be rotated on limiter 61 about this axis. At the sealed end, wall 71 slopes toward said axis to meet wall 72.

Whereas limiter 61 presents an equable convex surface as an arbor for elements 65s, this surface is extended in abutment with said interior wall 72 for the length of container 60. Protruding boss 66 molded into said surface is tightly accommodated in a recess defined by wall 72. By this means container 60 and limiter 61 form an integrated whole which the end user of the apparatus is not invited to disassemble. Additional attachment means such as glue may be employed to completely secure 60 to 61.

At the open end of cavity 67 sufficient space is provided on said arbor for seven elements 65s. When all seven are accommodated on limiter 61 (without lid 63) walls 72 and 71 form annular stops which cooperate with the lips 69, 70 at the other end of the limiter to confine the elements 65s in preparedness for their use in a puzzle to be made with the apparatus. General principles concerning the

operation of the puzzle are described in U.S. patent 4,632,399 with reference especially to figures 8 - 12.

By way of an alternative mode of construction, the user may choose to deploy lid 63 on limiter 61 instead of a certain number of the elements 65s. By reducing the number of elements 65s in the puzzle, the user may construct a simpler puzzle. Preferably lid 63 replaces three only elements 65s, although it may replace four as I have suggested in figure 1 or some other number as would be clear to those skilled in the art.

With reference to figure 7, lid 63 has an interior wall and an exterior wall which in combination with the interior wall and exterior wall of container 60 will form a housing. Said housing defines a storage space 180 which includes cavity 67. At the closed end of lid 63, a flat wall 86 closes off the storage space and externally cooperates with lips 69, 70 to delimit the space for elements 65s on the limiter. At the other end of lid 63, a curved lip 64 protrudes into cavity 67 to bind container 60 and lid 63 together.

With reference to fig. 1, along most of its length lid 63 defines a gap 68 generally subtending 90 degrees in a plane orthogonal to the axis of rotation. Lip 64 adds to the length of 63 and subtends less than 270 degrees so that gap 68 is wider at lip 64 than it is elsewhere. Inside cavity 67, lip 64 serves to rotationally limit lid 63 relative to container 60, through its confinement by said flat walls 73, 74.

Lid 63 is formed from a resilient plastic and may be squeezed to slightly reduce the size of gap 68. When held squeezed thus, lip 64 slides easily into the cavity 67 defined by container 60. Upon releasing the pressure on 63, the user will find that lip 64 forcefully abuts with the inside of exterior wall 71. The force of friction then stops lid 63 from moving longitudinally along 61 to inadvertently obstruct the

rotation of elements 65. This is due to boss 66 which, as shown more particularly in figure 7, securely locates container 60 longitudinally of the axis relative to 61.

In order to facilitate the mounting (and later demounting) of lid 63, the lip 64 may be reduced at the extremity of its first insertion into the cavity 67. From there it may embody a gradual widening so as to rotationally limit lid 63 more and more as the lid is brought to its resting place against container 60. At its final place of rest, ready for the mounting of elements 65s at its end, any rotational latitude for 63 relative to 60 should be minimal. Thus lid 63 and container 60 are designed to present an integrated structure which the user may hold in one hand when rotationally manipulating elements 65s on the limiter.

Said first apparatus includes a handle 99 which may be turned relative to said integrated structure in order to provide sixty degree rotation of a selected subset of the elements 65s. With reference to figure 5, torque may be transmitted from handle 99 to selected elements 65s through semi-cylindrical long member 119 (shown with its concavity facing out of the page) and projectional units, such as unit 21 for example, which have been rotationally locked to 119 in the assembly of a core for the puzzle. The invention may include means of attachment of handle 99 to long member 119 whereby 99 may be released from 119 and temporarily deployed at the opposite end of the core. Such means may include a semi-cylindrical holder 109 with the interior radius of 109 matching the exterior radius of the curvature of 119 about the axis. Member 119 may be forced against 109 by another part of the handle as would be clear to those skilled in the art.

With reference to figure 4, spindle 112 is molded to bead 143 as if to extend through a hole in the bead and, when emerging from the bead, spindle 112 forms a resilient bent portion 114 including the bend 195 proximate to the bead. Between bead 143 and bend 195, the spindle includes a small shoulder 175

whereupon the second long member 140 is stopped with its end flange 142 abutting said shoulder.

The spindle 112 is molded as a separate component, including bead 143, shoulder 175 and bent portion 114, and the user may separate 112 from the other components of the core, whereas in the prior art device the central spindle was a fixed part of the semi-cylindrical long member (elsewhere referred to as the first member).

With reference to figure 5, grooved long member 140 (elsewhere referred to as the second member) defines groove 141 adapted to slidably locate the ridge 62 of the semi-tubular limiter. At the end opposite catch part 137, member 140 has a flange 139 which defines a hole for spindle 112.

During assembly of the core, the spindle 112 is inserted first through bearing means 144, 145 attached to semi-cylindrical long member 119 at the end opposite handle 99. The bearing means 144, 145 may be included with the same molding as member 119 and 145 defines a hole for spindle 112 which closely fits the spindle without preventing rotation of the spindle relative to 119. (Refer figures 3 and 4 to identify said bearing means.)

The arrangement for rotatably holding the spindle 112 at the end shown in figures 3 and 4 may also include said bearing means 144, 145 in a separate molding from long member 119 and such is the arrangement more particularly shown in the drawings. In this case, bearing means 144, 145 should be glued or welded to 119 at manufacture. Part 145 comprises a lump attached to the concavity of 119 at the end thereof and part 144, molded with 145, extends the bearing means beyond the end of said concavity. Part 145 defines the hole for spindle 112 and when the spindle is fully inserted bead 143 rests rotatably against 145 while part

144 accommodates the bead. The bead is accommodated so that it and part 144 extend the same distance longitudinally of the axis away from part 145 and thus together they provide a surface of abutment for flange 142 of member 140. By means of this abutment and, at the other end, the abutment of flanges 111 and 139 (refer figure 5), the long member 140 and the long member 119 are held in mutual engagement longitudinally of the axis.

With reference to figure 5, after inserting the spindle 112 through said bearing means, the user may mount projectional units on the spindle one by one, bringing some of them into rotational engagement with long member 119 and others into rotational engagement with long member 140. Spindle 112 is then inserted through a hole defined by flange 111 which flange may also be included in the same plastic molding as member 119. Thus holes in 145 and 111 define positions for spindle 112 at the ends of the pattern of projectional units assembled in the core. These positions are defined in relation to member 119 to facilitate rotation of member 119 about the longitudinal axis of the spindle 112. Thus when an assembled puzzle core is put into the limiter and its cargo, the axis of rotation for elements 65s on the limiter will approximately coincide with the longitudinal axis of spindle 112 as the exterior surface of 119 rotatably abuts with the interior surface of limiter 61.

The projectional units of the core, being identical with those of the prior art device, each define an axial orifice. During the user's assembly of a puzzle core, after spindle 112 has been inserted through the axial orifice of each projectional unit, spindle 112 is finally inserted through a hole in said flange 139 possessed by long member 140. Here member 140 rotatably abuts with flange 111 of member 119. Then member 140 is brought down upon the shoulder 175 of spindle 112 at the other end of the core as the member engages some of the projectional units, for example unit 22. With reference to fig. 3, the catch part 137

of member 140 then engages 114, forcing the spindle to bend further at bend 195. Catch part 137 is pushed over spindle portion 114, finally releasing it. When 114 resiles, it moves into an enclosure defined by 137 (bottom), side walls 136, 135 and end wall 176 of the long member 140. It is trapped in there, as shown particularly in figure 4, until such time as it may again be forced aside from 137. Walls 135 and 136 are parallel projections off flange 142. They run parallel to the axis and are joined by end wall 176. Thus catch part 137 is a partial bottom for the well defined by 135, 136, 142 and 176. End wall 176 defines hole 88 proximate the end of 114 so that force may be applied to 114 by the insertion of a rigid rod or protuberance through 88.

The cross-section of figure 4 is taken in a plane which includes said axis. Thus it may be seen that catch part 137 and flange 142 define an opening 194 which extends radially away from shoulder 175. This opening should be large enough to contain 114. Whereas 114 may be forced into the opening by pressing its end towards 144, the opening will not ordinarily contain 114. In its resting position as shown in figure 4, 114 will make a lesser angle to said axis than it must when forced to occupy said opening. Indeed the occupation of said opening by 114 will allow catch part 137 to move past 114.

With reference to fig. 5, member 119 extends beyond said abutting flanges 139, 111, longitudinally of the axis, to lodge frictionally in a recess defined by handle 99. When 99 and 119 are lodged together for normal puzzle operation they form an integrated whole assisted by the bonding force of friction to transmit torque from the user's hand. Torque is applied by the user between handle 99 and the housing formed at least by container 60 and, if it is present, by lid 63. Such torque may cause rotation of one element 65 relative to another if the two elements 65s are suitably positioned longitudinally of the axis relative to the pattern of projectional units in the core. Each unit holds a barrier pointing away



from said axis so that an element 65 when positioned over the unit will be rotationally limited by the barrier. Such an element may be forced to rotate on the limiter if the unit underneath is rotationally engaged with member 119 rather than member 140.

In manipulating the prior art device, a user would position the core longitudinally of the axis relative to the annular indicator elements by holding the indicator with fingers of both hands and selectively applying pressure to the ends of the core with the palms of the hands. Then the rotation, through sixty degrees, of one subset of the elements in relation to its complementary subset would be achieved through the direct application of torque to the elements. This mode of operation gave the prior art device a similarity to other puzzle devices that were popular in the market.

By contrast, according to the present invention, torque is not applied directly to the annular elements. Moreover, in use of the first illustrative embodiment, since the user holds handle 99 in one hand, and said housing in the other hand, for rotating one subset of elements 65s relative to its complementary subset, it is natural that longitudinal repositioning of the elements should be achieved through the pushing or pulling of handle 99 in relation to said housing. This mode of operation also informs the construction of the second illustrative embodiment of the invention and is the generally preferred mode because of its association with the possibilities of dramatic expression occurring when the elements 65s have been so positioned that their large keyways 96s are aligned with the delayer means 134. In accordance with the known art, such alignment permits the withdrawal of the core from the limiter.

With reference to figure 6, handle 99 may define a recess 90 adapted to accommodate the structure of walls 135, 136, 137 and 176 at one end of long

member 140. Handle 99 comprises an outer wall which forms the user's grip surface and a flat interior web wall 91 normal to the geometrical axis of the cylinder (this axis is also the axis of spindle 112 when the handle 99 is attached to 119). The interior web wall creates a forward compartment in which two concentric annular walls (one being said outer wall) define an annular gap therebetween for the frictional lodgement of semi-cylindrical long member 119. This forward compartment is not shown in detail but the web wall also creates a rear compartment in which, as shown in figure 6, a wall 93 perpendicular to the web wall defines the recess 90. Inside recess 90, also protruding from the web wall at ninety degrees, a slender protuberance 89 is firmly mounted. It is envisaged that 89 would be part of the same plastic molding as the other parts of handle 99.

With reference to figure 6, recess 90 is so shaped by wall 93 that it will accommodate the end of the long member 140 only when that member is oriented in a way that brings protuberance 89 and hole 88 (refer figures 3 and 4) into close proximity. This facilitates the user to insert protuberance 89 into 88 and apply force to spindle portion 114. When 114 has been moved clear of 137, protuberance 89 may be withdrawn and the long member 140 may be drawn away. Spindle 112 may then be withdrawn, releasing the projectional units and allowing a different puzzle configuration to be embodied.

With reference to figure 9, said second apparatus is constructed broadly the same way as said first apparatus. Whereas each annular element 201 defines one large keyway and five smaller ones, in the puzzle solution state as shown in the drawing, each element 201 has been positioned on the limiter so that its large keyway is lined up with the obtruding delayer means 202 at the catch end of the core. In this state, by pulling handle 203 in relation to the container 208 and lid 207, the core may be slid out of the limiter.

With reference to figure 8, in accordance with the known art, the limiter 213 rotatably abuts with the convex outer surface of semi-cylindrical long member 209. This allows torque applied to the limiter to effect a rotation of projectional unit 212 in relation to projectional unit 210 through a maximum of 60 degrees just.

Each projectional unit provides a barrier, for example barrier 211, adapted to extend into a keyway defined by an element 201. In one state of the core, as depicted in figures 8 and 9, the barriers are approximately aligned with delayer means 202 and the elements 201s may then be readily displaced longitudinally of the axis in relation to the barriers. Similar longitudinal displacement of the elements 201s is facilitated after limiter 213 has been rotated to the maximum extent possible on member 209.

With further reference to figure 9, but broadly in description of the invention, it may be appreciated that the core is wand-like, a quality rendered by the use of a handle (e.g. handle 203) which extends the first long member, longitudinally of the axis of rotation, substantially beyond the point where the second member is pivoted at the end opposite the delayer means. The wand-like quality is also dependent upon a fastening device to keep the projectional units in the core when the core has been withdrawn from the limiter. Whereas a wand-like core invites its own waving around after its withdrawal from the limiter, in the current invention the core acquires further significance as a means of gesturing. It may be held by handle 203 and pointed in the air, after its withdrawal from the limiter, as an expression of triumph.

With reference to fig. 8, a game in accordance with the invention may be enhanced by the specification of a curriculum of puzzles. Said curriculum may

suitably contain a dozen or more puzzles specified in reference to the sequence of projectional units of the puzzle core, each specification determining, for each projectional unit, whether it is rotationally engaged to limiter 213 or alternatively to long member 209. The game may then involve an adopting or a modifying of this curriculum by the players followed by a series of rounds or sub-games in each of which a puzzle is assembled by one of the players and solved by the other. A rigid incentive, such as a coin 218, may be inserted by the player assembling the puzzle and later retrieved by the player solving it. Depending on whether lid 207 is deployed or not, coin 218 may be held either in lid 207 or in container 208, in either case being retrievable through the opening exposed when elements 201s are demounted from the limiter 213, but otherwise being locked inside the puzzle. Tabs may be provided to hold coin 218 in a fixed position and the lid or the container thereby holding the coin may define a viewing aperture whereby the presence of the coin may be ascertained before the puzzle is solved.

If the puzzle apparatus has four annular elements and sixteen projectional units like, for example, the apparatus of figures 8 and 9, a time limit of the order of 60 seconds or thereabouts may allow sufficient wins in sufficiently many cases, as between adults and older children. Timing would begin upon the handover of the assembled and randomised apparatus. In this context, the withdrawal of the core from the limiter would signal completion of the timed action and a gesturing with the core could be an accompaniment to this completion, assuming completion to have been achieved within the accepted time limit.

In the apparatus of figures 8 and 9, the end wall 206 has a rounded external aspect to give the assembled apparatus, as a whole, a rocket-like appearance. Correspondingly the handle defines a circular recess 205 adapted to accept 206 when the handle is removed for deployment as a release means in accordance

with the procedure outlined for the apparatus of figures 3 and 4. In the case of the apparatus of fig. 9, the procedure also involves aligning protuberance 204 in the handle so that it may penetrate the hole in end wall 206.

End wall 206 corresponds with end wall 176 in the first illustrative embodiment but overhangs the well for the bent spindle portion rather than merely delimiting it. In the apparatus of figures 8 and 9, the end wall is given an aesthetic function and the rounded external aspect has no particular mechanical significance.

Congruent annular elements are preferred and have been employed in both of the apparatuses depicted. Where congruent annular elements are employed, they are preferably supplied in a single colour whereas colour differences between them would frustrate the educational value of using colour to identify the elements once mounted. For the purposes of discussing puzzle solutions, it is essential to identify the annular elements by their ordinal position proceeding along their common axis of rotation. To this end, reference fig. 9, the coloured markers 214, 215, 216 and 217 have been included in said second apparatus as separately molded pieces which are attached to the lid 207 at the time of manufacture, after molding. Preferably each marker is a different colour and each colour stands out from the background colour of the lid.

The foregoing description outlines the preferred manners of constructing the invention, with the possible exception that transparent outer walls for container 208 and lid 207, or container 60 and lid 63, would in some circumstances be preferred to opaque walls. This would facilitate easier viewing of any incentive held inside. In addition it is preferred to accommodate sixteen only projectional units in the puzzle core, each unit having the same extent longitudinal of the axis as each rotatable annular element on the limiter. Some modifications to these preferred arrangements are briefly described in what follows.

With reference to figures 3 and 5, the second member 140 of said first apparatus defines a notch 155 communicating with groove 141. This notch has no function in the apparatus as depicted. However in an envisaged modification of the invention, ridge 62 of the semi-tubular limiter may include a moveable arm having an end adapted to lodge in said notch and, after being so lodged, adapted to move out of said notch when the core, including member 140, is moved with a certain force longitudinally of the axis relative to the limiter and said arm. By means of such notches, a series of stations may be defined for the limiter, in each of which stations each element 201 will be rotationally limited by a single one only of the rigid barriers such as barrier 211.

~~In another modification of the invention, more particularly adapting the invention for older users, the housing is not included as the facility to hold an object of incentive is not required. However in this case, the function of the lid in optionally replacing a number of the annular elements may still be required. Addressing this function, the lid may be called a spacer and a spacer more generally may not define or close off any storage space for an incentive. In any case, means should be provided to hold the spacer fixed both rotationally and longitudinally of the axis in relation to the limiter for as long as the puzzle core is slidably lodged in the limiter.~~

In a further modification of the invention, a game is played between two players being a type of hide-and-seek wherein one player hides a precious object and draws a map for the other player showing the whereabouts of the hidden object. However the map is not shown directly to the other player but cut into portions. Each portion in turn is secured in the storage space defined by the housing on the limiter and then the apparatus is randomised before it is passed to said other player. Thus said other player must retrieve each portion of the map by solving a

puzzle constructed by the first player. When the entire map has been retrieved and the hidden object has been found by said other player, the roles may be reversed. Players may keep records of their successes and may follow a curriculum in determining how to assemble the core of the apparatus.

These and further modifications may be incorporated without departing from the scope of the invention as hereinafter claimed.